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AVERAGE MULTIPOLARITIES OF QUASI-CONTINUUM TRANSITIONS FOLLOWING THE (α , 4n) REACTION FROM MEASURED INTERNAL CONVERSION COEFFICIENTS

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The quasi-continuum of electromagnetic transitions following the $^{160}\text{Gd}(\alpha, 4n)^{160}\text{Dy}$ reaction exhibits predominant E1 character. This is concluded from conversion electrons observed with a mini-orange spectrometer and corresponding γ -rays, both being selected by coincidences with discrete ground-state band transitions in ^{160}Dy .

The angular momentum effects in the bulk properties of nuclei and in the mechanism of reactions induced by α -particles and heavy-ions are now qualitatively well recognized [1]. The dissipation of angular momentum is thought to proceed via a few electromagnetic transitions of relatively high energy but low multipolarity and subsequently via a cascade of stretched E2 transitions along the yrast line. The description of this process, however, is still in an early stage and far from quantitative. One of the recent promising developments is an extension of the in-beam γ -ray spectrometric techniques to the region of states with high spin ($J=20-70$) and high excitation energies ($E=3-20$ MeV). Although the level density does not imply significant overlap of levels within their natural widths, it is large enough to render the observation of individual γ -transitions impractical. The observed apparent "continuum" requires specific detection and analysing methods [2] to deduce spectroscopic information.

Evidence has been reported [3,4] for a gross structure of the quasi-continuum with two main components: a low-energy part which exhibits in certain reactions a relatively sharp edge at its high-energy side, and an exponential tail which extends to higher energies. The range and strength of the two components depend on the initial angular momentum brought into the compound system. The angular distributions of

the low-energy component were found [4] to be anisotropic and consistent with stretched E2 radiation. In the exponential tail the distributions became nearly isotropic. The latter finding may be plausible explained by assuming a statistical (and thus partly non-stretched) character of the exponential component. This has been questioned in recent work [5] on angular distributions of the quasi-continuum following the $^{144}\text{Sm}(^{16}\text{O}, 2n)$ reaction, where the dominance of quadrupole radiation has been reported for energies even up to 5 MeV. This is at variance with the presently reported result. However, it should be born in mind that the interpretation of observed angular distributions in terms of multipolarities requires several assumptions, and does not yield unambiguous results even for observed discrete transitions. For an incoherent mixture of transitions between a large number of states, quantitative conclusions are practically excluded.

This paper presents the first experimental determination of the multipolarity of the quasi-continuum transitions as a function of energy from measured conversion coefficients. The reaction $^{160}\text{Gd}(\alpha, 4n)^{160}\text{Dy}$ induced by 47 MeV α -particles from the Groningen cyclotron was chosen to excite a nucleus with a well studied ground-state rotational band (g.s.b.). The conversion coefficients were determined from simultaneously measured γ -ray and electron spectra, both in coincidence with the discrete g.s.b. transitions. The gating transitions were observed with a 110 cm^3 Ge(Li)

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